UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Summary Review of Monthly Reports*
for
SOIL CONSERVATION SERVICE RESEARCH**
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Conservation and Use of Water by Specialized Use of Level Terrace - Harley A. Daniel, Guthrie, Oklahoma.-"The conservation value of collecting runoff water from higher, sloping land and spreading it on lower, more level, deep, permeable soil is being studied at the Wheatland Conservation Experiment Station, Cherokee, Oklahoma. The experiment was started in the summer of 1944 by constructing level terraces on intervals of one foot in a 'syrup pan' (spread and spill) type of arrangement. This forces the water to completely cross the field of the interval between each terrace.

"The area has been completely flooded 30 times since the experiment was started. Six of these floods occurred during the growing season of 1948 and eleven in 1949. The rainfall was about average in 1948 and extremely high throughout the growing season of 1949. As the water moved slowly back and forth over such a large surface, much of the surplus was absorbed by the soil. The water retained was used advantageously by alfalfa. This method of spreading and conserving the excess water practically doubled the yield of alfalfa in 1948 and also increased it 29 percent during the extremely wet season of 1949. In fact, the excess moisture increased the yield of alfalfa an average of 51 percent during this period. And it also prevented water from collecting in a pond that formerly developed in the northwest corner of the station. The 'syrup pan' (spread and spill) terraces, therefore, may serve some very important purposes on valuable wheat and alfalfa land typical of northwestern Oklahoma:

(a) In many places it has possibilities of increasing crop yields and at the same time provide the most desirable terrace outlet for the excess water.
(b) On other areas it may also be used to prevent the excess water from accumulating in ponds and destroying crops."

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** All research work of the Soil Conservation Service is in cooperation with the various State Experiment Stations.

Improving Soils Underlain by Shallow Claypan - A question in soil management frequently asked by students and operators can be put something like this: Given a piece of land possessing a favorable slope and climate and supplied with good water, but underlain at a shallow depth (say 18 inches) by a claypan, what can be done mechanically to improve such land for trees by breaching the claypan? The answer to this question is generally 'not much can be done'. Chiseling (or subsoiling) is usually confined to depths of 16 inches or less. Moreover, chiseling, or similar tillage, merely breaks the claypan temporarily. With the first liberal application of water, by rainfall or irrigation, the clayey material runs together, forming a layer about as impermeable as before treatment.

"There are two mechanical methods, both old basically but new with respect to the kind of machinery now available, that may be worth trying in the soil management problem outlined above. One uses the ditch-digging machine, the other the large post-hole digger attached to a wheel tractor.

"Ditch-digging machines may be rented in a wide range of sizes and models. The type best adapted for breaching a shallow claypan digs to a depth of 24 to 30 inches and makes a trench about two feet wide. The dug material is dumped on either side of the trench, with the clayey material on top of the heap. As used in a trial to improve a claypan soil, the bottom of the trench is filled with organic matter (dairy manure, prunings, spoiled alfalfa hay or cereal straw) and the trench backfilled with a small bulldozer or light terracer blade. A bulky type of cover crop such as mustard or pigweed is later grown on the disturbed area. Ideally, the trench would be dug along the line where trees are to be planted. In an established orchard his, of course, is not possible and the ditch would be dug in the middle of the irrigated space. Where a new orchard is to be planted on an old tree soil, consideration might be given to (1) shifting the new tree line to the old irrigated middle and (2) digging the trench well in advance of planting to give the dug matter a chance to weather.

"The new large post-hole digger attached to and powered by a light wheel tractor is a fast, efficient tool for digging holes in soil to a depth of 36 inches. Where soil conditions are favorable, upwards of 600 holes can be dug in a day. As used in a trial to improve a claypan soil, five holes were dug in the area formed by the intersection of the irrigated middle with the dry middle. One hole was located in the exact center of this area, the other four being spotted around the center on the tops of previous ridges hardened by orchard traffic. On the bottom of the outside holes spoiled alfalfa hay was laid and the soil back-filled. The center hole provided the spot for a newly planted tree.

"Under proper working conditions, the post-hole digger will open a hole 18 inches in diameter and three feet deep at a cost of about seven cents. Charges for trenching with the ditch-digging machine vary widely and would have to be determined locally. Whether the benefits are commensurate with the costs is yet to be determined. Information now at hand concerning the trial with the post-hole digger is that the young trees are making satisfactory growth. The rate of water intake in the middles in which holes were punched with the digger has increased four-fold."

Runoff in Relation to Types of Vegetation and Soil Treatment - D. D. Smith, Columbia, Missouri.-"The 1949 runoff from the three 2-acre pasture areas equipped with rate measuring flumes and waterstage recorders emphasizes the tremendous effect that fertility and type of vegetation have on runoff during the different periods of the year. Growing crops transpire moisture in relation to amount of growth per unit area, which in turn empties the soil reservoir so that it can absorb a greater amount of the next rain. Early spring and late fall and winter growing pasture vegetation can materially lessen runoff during these periods. Soil treatments that affect growth of the vegetation to produce more annual gain and less runoff at lower rates may be considered as a potential flood control practice. These data by 3-month periods are as follows:

Period and Item	Untreated Bluegrass Pasture - mixed Bluegrass, annual weed grasses, and weeds	N-P-K Treated Bluegrass Pasture - Very few weeds or weed grasses	Deep-Treated Pasture. Rough Plowed until seeded to Bromegrass and Ladino clover in April
Jan.-Feb.-March:	Rainfall for 3-month period - 12.55 inches		
Runoff:			
Amount	7.76"	7.80"	8.10"
Peak rate	0.68"/hr.	0.52"/hr.	1.18"/hr.
Remarks:	Vegetation dominant or dead.	Ammonium Nitrate applied (March)	Rough plowed.
April-May-June:	Rainfall for 3-month period - 11.12 inches.		
Runoff:			
Amount	0.66"	0.21"	0.35"
Peak rate	0.48"/hr.	0.14"/hr.	0.35"/hr.
Remarks:	Good growth, all types.	Lush Bluegrass	Seeded April 20
July-August-Sept.:	Rainfall for 3-month period - 13.63 inches.		
Runoff:			
Amount	1.30"	0.95"	0.57"
Peak rate	1.20"/hr.	0.82"/hr.	0.62"/hr.
Remarks:	Mixed cover.	Ammonium Nitrate Applied (Sept.)	Ladino, Brome, and foxtail.
Oct.-Nov.-Dec.:	Rainfall for 3-month period - 8.71 inches.		
Runoff:			
Amount	2.49"	1.35"	1.79"
Peak rate	0.58"/hr.	0.41"/hr.	0.47"/hr.
Remarks:	Some bluegrass; other grass and weeds dormant.	Lush bluegrass.	Ladino clover and bromegrass, good growth.

Grazing Rate for Tall Fescue - D. D. Smith - "Considerable interest has been expressed for grazing rates for tall fescue. While 2 years' records are available, grazing during 1948 was such as to favor the young legume seeding. This was not the case during 1949.

"We followed the practice of not grazing from mid September to mid November to permit recuperative growth and nutrient storage. Another way of using tall fescue is to fertilize it with nitrogen in September, let grow until December, use a winter pasture, take a full seed crop the next year, mow and stack for rough hay after seed harvest. This latter management would certainly be good while the price of seed remains high. If one did not want the seed, it could of course be grazed in the spring. The only difference between this and our method of grazing this year is the delay until December for grazing. The use of other pasture until December, saving fescue for the early winter, is a promising method of extending the grazing season in this section.

"The following data are by one-half month periods in animal units per acre. There was evidence throughout the year of nitrogen shortage, and production was only 172 pounds per acre. We believe that this calendar represents the minimum that may be expected from tall fescue pastures in this section.

April - 0.17	July - 0.73	Oct. - 0
1.11	.73	- 0
May - 1.21	Aug. - 0.47	Nov. - 0
.77	.37	0.89
June - 0.71	Sept.- 0.33	Dec. - 0.82
.72	0	0

Water Conservation Practices in Relation to the Need for Supplemental Irrigation - O. R. Neal, New Brunswick, N. J.-"Drought conditions during the 1949 growing season have led to a greatly increased interest in supplemental irrigation in this state. The New Jersey Agricultural Extension Service has a committee appointed to consider the irrigation problem. The Project Supervisor serves on this committee and took part in four area meetings held during January. At these meetings the inter-relationship of good physical conditions of the soil and other conservation measures to the control of runoff, availability of soil moisture, and need for irrigation was pointed out. Conservation practices which maintain good physical conditions of the soil will reduce runoff during the growing season in amounts varying from 2 to 4 inches. Possibly 2 additional inches of water can be conserved by supporting these practices with mechanical conservation measures depending on characteristics of the land. This reduction in runoff and resulting increase in quantity of water entering the soil will reduce the need for irrigation in all years and may iminate the need in many cases. The need for effective conservation measures under irrigation operations was further emphasized purely for protection of the land. In a humid climate there is the everlasting possibility that irrigation operations will be followed shortly by heavy rainfall. In such a situation excessive amounts of runoff and erosion may occur if the land is not well protected."

Wheat Yields in Relation to Precipitation - Charles J. Whitfield.-"Precipitation and wheat yields, given below are data from the Amarillo Conservation Experiment Station for the past 8 years. An up-and-down yield every other year has been fairly consistent. Also, a rather close relationship appears between precipitation from July 1 (following harvest) until June 30 (harvest time).

Year	Precipitation		Yield - Bu. per Acre (Wheat after wheat)
	Annual	July 1 - June 30	
1942	18.50	26.53	20.1
1943	17.06	17.30	7.6
1944	21.69	21.21	26.0
1945	12.93	15.66	5.6
1946	15.88	13.50	8.2
1947	14.35	20.82	27.0
1948	20.38	13.64	2.4
1949	24.52	27.04	20.2

Milo Grain Yields in Relation to Cultural Treatment - A. E. Lowe, Garden City, Kansas.-"The milo grain yields on the Basin Project are given in the accompanying table. The yields are excellent this year and only in 1945 were they higher during the ten years this project has been in operation.

"Again this year for no known cause the yields in the 84 inch rowed plot of ordinary listing up and down the slope were unusually high. Otherwise yields were about in line with the ten year averages.

"The yield data table gives the 1949 grain yield and also the ten year averages. The ten year average of all contour plots is 22.2 bushels per acre whereas the ten year average of all non-contour plots is 18.8 bushels per acre. This is an increase of 3.4 bushels per acre or 18% for contouring over non-contouring.

"The ten year average of all basined plots is 20.8 bushels per acre whereas the ten year average of all non-basined plots is 20.1 bushels per acre. This is an increase of only .7 bushels per acre or 3 percent for basining over non-basining and is probably not significant.

Milo grain yields in bushels per acre obtained on the basin project plots at Garden City, Kansas in 1949 and an average of the last ten years.

Cultural Treatment	1949	10 Yr. Average
42" listed rows, continuously cropped (a)		
Basined on contour	35.5	20.3
Ordinary list on contour	38.7	22.6
Basined up and down slope	31.1	16.2
Ordinary list up and down slope	25.8	15.4
84" listed rows, continuously cropped (b)		
Basined on contour	24.9	16.2
Ordinary list on contour	24.6	16.2
Basined up and down slope	23.0	15.2
Ordinary list up and down slope	20.1	16.4
42" listed rows, one year fallow (a)		
Basined on contour	51.4	31.0
Ordinary list on contour	44.5	26.7
Basined up and down slope	47.7	26.1
Ordinary list up and down slope	35.5	23.2
Average of the above three groups of treatments		
Basined on contour	37.3	22.5
Ordinary list on contour	35.9	21.8
Basined up and down slope	33.9	19.2
Ordinary list up and down slope	30.5	18.4
Average	34.4	20.5

(a) 44 inch rows prior to 1947 - (b) 88 inch rows prior to 1947.

Summary of Cooperative Tillage Field Trials - 1949 - Torlief S. Aasheim, Havre, Montana.-"During 1949 five counties, Roosevelt, Sheridan, Cascade, Yellowstone and Hill carried field trials to completion. The data which was recorded on these trials by County agents and District Conservationists is summarized in the following table.

"From contacts made with farmers, county agents and soil conservationists it seems that everyone is pretty well agreed that stubble mulch tillage is a good conservation practice. There are some objections to the practice, however, which have tended to prevent it from being rapidly adopted. The objections most frequently encountered are:

1. Difficulty of operating sub-surface tillage equipment.
2. Difficulty in controlling weeds.
3. Difficulty in seeding.
4. Reduced protein content of wheat.

"As far as operation of equipment is concerned draft and clearance seem to be the chief complaints. These difficulties can be almost entirely overcome if the machines used are properly adjusted and designed with a maximum of clearance.

"Some weeds are difficult to control with sub-surface tillers. The weeds which give the most trouble are weeds which are surface feeders and have a shallow fibrous root system. Shallow tillage with sweeps which tend to stir the soil will generally result in satisfactory weed control unless rain immediately follows cultivation.

"There is a great deal of difference in the ability of different drills to seed in stubble mulch. The double disc drill tends to roll over heavy trash and as a result the seed is not placed in a satisfactory position. This type drill also clogs easily if discs are not turning freely. The single disc drill will cut through trash a little better than the double disc drill but otherwise it has about the same limitations.

"Furrow drills equipped with disc openers will operate in more trash because the wide spacing between discs result in less clogging and the larger discs with greater concavity tend to push the straw aside and place the seed in the soil rather than on top of the straw. The furrow drills with shovel openers are probably the best suited to seeding in stubble mulch of any drills available. The shovels work under the straw, placing the seed on a firm seedbed. The amount of residue a drill of this type will seed through depends on the distance between shovels in each row and the distance between each row of shovels. In working stubble mulch fallow during the fallow season the operator should always adjust his method of cultivation so as to leave no more residue on the surface than he can seed through with his seeding equipment.

"Protein content of wheat is usually less under a system of stubble mulch fallow than it is on black fallow. This difference has been about one percent over a period of years with higher than average yields at Froid and approximately one-half of one percent over a period of years with average yields at Havre. It is possible that the addition of nitrate fertilizers or barnyard manure might raise the protein content of wheat on stubble mulch fallow, but even though it would it seems doubtful whether the addition of fertilizer would be justified to accomplish this alone, since the difference is so small.

Summary of Observations and Results from Tillage Field Trials, 1949

Location & Method	Fallow Season					
	Amount of Stubble	Weed Control	No. of Operations	Erosion Wind	Erosion Water	Moisture Penetration
Billings - Schock						
Conventional	Heavy	Satisfac.	3	0	0	18"
Stubble Mulch	Heavy	Satisfac.	3	0	0	16"
Great Falls - Shane						
Conventional	Light	Satisfac.	5	0	0	46"
Stubble Mulch	Light	Satisfac.	4	0	0	44"
Medicine Lake, Hjort						
Conventional	Light	Satisfac.		Light	0	48"
Stubble mulch	Medium	Satisfac.		Light	0	48"
Conventional	None	Satisfac.		Light	0	48"
Stubble Mulch	Light	Satisfac.		Light	0	48"
Havre - Brownlee						
Blade & Packer	Medium	Satisfac.	3	0	0	42"
Oneway	Medium	Satisfac.	3	0	0	48"
Plow	Medium	Satisfac.	3	Light	0	42"
Blade	Medium	Satisfac.	3	0	0	42"
Froid - Demonstration Farm						
Sprayed and Subtilled*	Heavy	Satisfac.	3	0	0	
Sprayed, Subtilled & fall chiseled*	Heavy	Satisfac.	4	0	0	
Subtilled - Oneway seeder*	Heavy	Satisfac.	4	0	0	
Subtilled & fall chiseled	Heavy	Satisfac.	5	0	Light	
Subtilled	Heavy	Satisfac.	4	0	0	
Oneway & Rodweeder	Heavy	Satisfac.	4	0	0	
Plow & Rodweed	Heavy	Satisfac.	4	0	0	

* These treatments were all seeded with a oneway with seeder attachment. In the first two treatments where chemical spray was used, these plots were sprayed twice with 2,4-D and subtilled once.

Summary of Observations and Results from Tillage Field Trials, 1949

Location & Method	Crop Season						
	Residue at Seeding time	Erosion: Wind	Water	Stand	Weed Infestation	Bu. Yield	Percent Protein
Billings - Schock							
Conventional	Light	0	0	Poor	Light	4.5	12.9
Stubble Mulch	Heavy	0	0	Poor	Light	4.3	12.2
Great Falls - Shane							
Conventional	None	0	0	Good	None	25.7	14.3
Stubble Mulch	Light	0	0	Good	None	23.1	14.0
Medicine Lake, Hjort							
Conventional	Light	Light	Light	Good	Light	24.8	16.7
Stubble Mulch	Medium	Light	Light	Good	Light	23.1	17.1
Conventional	Light	Light	Light	Good	Light	22.4	17.0
Stubble Mulch	Medium	Light	Light	Good	Light	22.0	17.1
Havre - Brownlee							
Blade & Packer	Light	0	0	0	Medium	12.4	16.8
Oneway	Light	0	0	0	Medium	12.4	16.8
Plow	None	0	0	0	Medium	13.8	17.0
Blade	Medium	0	0	0	Medium	12.3	17.1
Froid - Demonstration Farm							
Sprayed and Subtilled*	Heavy	0	0	Medium	Light	17.4	14.7
Sprayed, subtilled and fall chiseled*	Heavy	0	0	Medium	Light	15.8	14.8
Subtilled - Oneway seeder*	Medium	0	0	Medium	Light	15.1	14.9
Subtilled & fall chiseled	Medium	0	0	Medium	Light	14.4	15.3
Subtilled	Medium	0	0	Medium	Light	14.5	15.5
Oneway & Rodweeder	Light	0	0	Good	Light	16.6	15.4
Plow & Rodweed	None	0	0	Good	Light	18.7	15.4

* These treatments were all seeded with a oneway with seeder attachment. In the first two treatments where chemical spray was used, these plots were sprayed twice with 2,4-D and subtilled once.

Effect of certain Vegetation and Tillage Practices on Organic Matter Content, Volume Weight, Aggregation, Percolation, and Porosity of Blackland Soils -J. R. Johnston, Temple, Texas.-"Dr. P. Sen, a type B trainee with the Soil Conservation Service from India has been working on the physical properties of Blackland soil as related to soil and moisture conservation. He has devoted his studies to the effects of certain cropping and vegetative practices on soil properties related to water transmission through these heavy clay soils. Soil properties studied have been organic matter content, volume weight, aggregation, percolation rates, and volume of soil pores drained at 60 cm. tnesion for some Austin clay and Houston black clay soils. The soils studied were cultivated and non-cultivated Austin clay, Austin clay in continuous cotton and in a 2-year cotton, Madrid sweetclover cropping system, and Houston black clay in continuous cotton and in a 2-year cotton, Madrid sweetclover cropping system. Organic matter content, volume weight, and aggregation determinations were made for the 1-4 inch layer of each soil. Percolation rates and volume of pores drained at 60 cm. of tension have been made for the 1-4 inch and 8-11 inch layers of each soil. The data from these studies are listed in the table on the following page.

"The organic matter content of the 1-4 inch layer of Austin clay was lowered from 5.19 percent to 2.28 percent in 70 years of cultivation. The increase in organic matter content of the Austin and Houston soils following a cotton, sweetclover system as compared with continuous cotton is surprising since this system has been in effect only 3 years.

"The samples used in these studies were obtained when the soil was moist. It has been found that aggregation data and water transmission rates in these soils differ considerably depending on the moisture status when samples are obtained. An example of this is the decline of 69.85 to 52.21 percent 2 mm size aggregates from dry sampling to moist sampling of the non-cultivated Austin clay surface soil. Another example is the decline of 35.93 to 14.61 percent 2 mm. in size aggregates in the cultivated Austin clay surface under the same moisture conditions when sampled.

"Another point of interest from these data is the apparent aggregate destruction following sweetclover in the rotation. This destruction of soil aggregate occurred in both the Austin and Houston soils. Note that the degree of aggregation is considerably greater for the Austin soil that it is for the Houston. The percolation rate data for the various soils are highly interesting. Note the very high percolation rates of the 1-4 inch layer of non-cultivated Austin, rotation Austin, and rotation Houston soils as compared with the much lower percolation rates of cultivated Austin and continuous cotton Austin and Houston soils.

Soil and Treatment	Soil Depth	Organic matter Content	Volume Weight	Percentage aggregates by size					Percolation rate at saturation*	Water drained in one hour at	
				2mm	1-2mm	5-1mm	2-5mm	2mm		60 cm.	tension **
	inches	%							inches/hr.	cc	%
Austin clay cultivated	1-4	2.28	1.23	14.61	15.61	20.12	22.50	27.18	0.004	2.8	0.805
	8-10								.000	4.7	1.352
Austin clay non-cultivated	1-4	5.19	1.17	52.21	27.33	9.24	4.98	6.25	5.500	21.8	6.273
	8-10								.260	13.7	3.942
Austin clay Cont. cotton	1-4	2.06	1.41	36.66	25.05	13.25	11.10	13.94	.320	19.0	5.467
	8-10								.320	18.2	5.237
Austin clay cotton, swcl. rot.	1-4	2.54	1.14	23.26	16.15	15.80	18.23	26.58	7.540	27.5	7.913
	8-10								.080	11.8	3.395
Houston black clay cont. cotton	1-4	2.96	1.00	4.46	9.80	25.20	20.58	39.96	.730	10.5	3.021
	8-10								.000	4.1	1.179
Houston black clay cotton, swcl. rot.	1-4	3.17	.94	1.31	5.83	10.95	20.74	61.19	4.900	24.6	7.079
	8-10								.000	2.8	0.805

* Percolation rates are averages from 6 core samples.

** These data may be taken to represent pore space. The value of pore space measurements for these soils, however, has not been determined.

"The relationship between organic matter content, degree of aggregation, percolation rates, and volume of pores drained at 60 cm. of tension for the cultivated and non-cultivated Austin soil bring out the beneficial effect of organic matter on soil structure and percolation rates.

"The inverse relation between aggregation and organic matter content of the continuous cotton and rotation Austin and Houston soils is not readily understood. Certainly these data are not in agreement with data collected from other soils. The sweetclover in rotation increased greatly the percolation rate of the 1-4 inch layer of both Austin and Houston soils. The percolation rate of the 8-11 inch layer was not increased by sweetclover. The volume of soil pores drained at 60 cm. of tension in the 1-4 inch layer of both Austin and Houston was increased by sweetclover.

"The fact that sweetclover increased percolation rates of the 1-4 inch layer is of considerable practical significance. The relationship between aggregate destruction and increase of percolation rate following sweetclover needs to be studied in more detail."

DRAINAGE AND WATER CONTROL DIVISION

Hydrologic Studies - L. L. Harrold, North Appalachian Experimental Watershed, Coshocton, Ohio.--"Precipitation of 8.18 inches for January was the second highest value in 60 years of record at Coshocton. Also unusual was the 12° per day above normal temperature. There was no snow during the month. Rain fell on 21 days--the greatest daily value being 1.54 inches. Most of the rainfall had the usual winter-type storm characteristic of low intensity. Runoff occurred on every watershed--soil permeability and vegetal cover being greatest factors causing different amounts. Maximum rainfall rate amounted to 1.92 inches per hour. Maximum runoff rates for all but the seep area (127) were less than 0.25 inch per hour. Apparently, most of the peak flows were made up of sub-surface flow. If they were mostly surface flow, they would have been somewhat over 1 inch per hour.

Table 1.--Monthly runoff from watersheds less than 3 acres

Watershed No.	Land use	Amount	Peak rate	Soil drainage
		Inches	Inches per hour	
131	Permanent woods	0.006	0.002	Well
132	-do	.226	.025	Slowly permeable
130	Permanent meadow	.346	.025	Well
103	Rotation meadow (I)	.800	.130	Slowly permeable
110	" " (P)	.266	.064	-do-
109	Wheat (I)	.043	.008	Well
115	" (P)	1.026	.246	Slowly permeable
123	" (I)	1.853	.226	-do-
127	" (I)	3.818	.969	-do- (seep spots)

Note: I = Conservation practices; P = Poor practices.

"Permanent woods greatly reduced the peak rate and total amount of runoff. Much of the water absorbed by the soil in these areas returned to the surface as stream flow further down the hill. Total runoff from a 303-acre area, over three-fourths of which is in grass and woods, amounted to 6.23 inches.

"Soil-moisture deficiencies were entirely eliminated, ground-water levels were fully recovered, and stream flow was more than back to normal by the end of the month. There is no lack of water in this area.

"The yield results of the 1949 mulch-culture and sub-soiling studies on Keene silt loam soil (slowly permeable) are given in the following table. Each figure represents the average of three plots. This table will appear on the next page.

"Again we are faced with poorer stands on the mulch plots. An examination of the root system of corn plants on subsoiled and normal plots indicated no difference in root penetration. Some difference may be apparent when the plots are in second-year alfalfa-timothy meadow. The objective of improving the permeability of soils below the 7-inch plow layer may yet be attained in this study.

"Corn yield of 144 bushels per acre was obtained on lysimeter Y102C. Here the stand was 21,000 plants per acre in 42-inch rows. A good alfalfa-timothy sod preceded corn and 300 pounds of 3-12-12 fertilizer was used in the row at planting time."

Chemical weed control[1]	Depth of tillage[2]	Surface treatment	Corn yield per acre	Stand per acre
None	Normal	Plow	57.4	10,300
-do-	-do-	Disk	51.8	8,500
None	Sub-soiled	Plow	68.5	10,990
-do-	-do-	Disk	54.5	10,020
2,4-D	Normal	Plow	61.1	9,470
-do-	-do-	Disk	38.6	5,800.
2,4-D	Sub-soiled	Plow	73.5	11,130
-do-	-do-	Disk	53.8	8,500

[1]Chemical applied pre-emergence.
[2]Subsoil chiseled 14 inches deep plus 1 ton lime and 200 pounds 3-12-12 fertilizer banded at 2-foot intervals to depths of 10 to 14 inches. "Normal" indicates no subsoiling and no additional fertilizer.

Hydrologic Studies - J. A. Allis, Central Great Plains Experimental Watershed, Hastings, Nebraska.-"No measurable precipitation was received at the meteorological station during January 1950. Light snows fell on three occasions which produced less than 0.005 inch of water content and were recorded as traces Between October 10, 1949, and January 31, 1950, or a period of 102 days, only 0.16 inch of moisture has been received.

"Temperatures for the month averaged about 3.6° below the long-time average and daily temperatures were very erratic. The minimum temperatures was -18.0° and the maximum daily temperatures varied from -1.0° to 69.2°.

"Peak rates and total runoff were compiled on the pasture plots for 1949, which are tabulated as follows:"

Average Peak Rates of Runoff, In Inches per Hour, Pasture Plots for 1949

	In/hr.
Untreated	0.85
Rennovated with eccentric disk	.58
Furrowed 12 to 16' horizontal spacing	.19
Furrowed about 5' horizontal spacing	.08

Average Total Runoff, In Inches, Pasture Plots for 1949

	Inches
Untreated	1.91
Rennovated with eccentric disk	.87
Furrowed 12 to 16' horizontal spacing	.30
Furrowed about 5' horizontal spacing	.17

Hydrologic Studies - Geo. Crabb, Jr., East Lansing, Michigan.-"January 11 the Project Supervisor, in company with Dr. A. L. Kenworthy and Prof. E. H. Kidder, was spent at the Graham Station of the Michigan Agricultural Experiment Station on the outskirts of Grand Rapids. The purpose of this trip was to make the preliminary investigations prior to expansion of the soil-moisture studies under orchards to include peaches. The experiment was designed, and plans were made to install 182 moisture blocks under three varieties of peach trees, with

three fertilizer treatments, and three cover management treatments. Installation of this study will be accomplished by representatives of the Project and the Departments of Agricultural Engineering and Horticulture. General maintenance of the studies and daily readings will be carried out by Graham Station personnel. Material will be furnished by the station.

"January the 13th material was furnished to Dr. S. H. Wittwer, Department of Horticulture, upon which to base his address to the Michigan Orchard Society, "Plant Physiology as Affected by Solar Radiation and Moisture."

"January 23 and 24 the Project Supervisor, in company with Collaborator A. L. Kenworthy, conferred with District Conservationist G. E. Springer and County Agricultural Agent Carl Hempstreet at Traverse City, Michigan, on the question of meeting the many requests of Michigan orchardists for information on the effects of cover, cover management, fertilization, and irrigation on soil moisture and tree and fruit development. It was decided that if the site and cooperator could be found, suitable for this specific study and that the equipment and instruments could be obtained, work would be started on this question. Necessary instruments are now available or can be obtained. Irrigation equipment is not now available, but may possibly be obtained through cooperating industrial sources, so considerable attention was paid to site and cooperator selection. A review of the interested cooperating farmers in the area and evaluation of their orchard and soil types narrowed the field of selection to a very few men. Following a full discussion of the personal and agricultural qualifications of these men, their record of cooperation with various agencies, their soil conditions, and their type of orchard management practices, it was decided to contact Mr. Robert Seeburg, who has a large orchard on the Old Mission Peninsular, on the matter. Mr. Seeburg was enthusiastic in his reaction and agreed to carry out a large part of the field work on any such proposed study, and to contribute heavily of his time and to a certain extent on the finances. The orchards in question are ideally suited to research work being typical of the area, well-managed, and successful in production, and conveniently located for such work. Mr. Springer offered the aid of his staff in certain phases of the work. Dr. Kenworthy and the Project Supervisor plan to continue the cooperative assistance already under way in soil-moisture studies under orchards to carry the study through. Immediately upon return to East Lansing, the latter two conferred with Collaborator E. H. Kidder, Department of Agricultural Engineering, and Mr. Paul Schleusner of the same department, in regard to the possibility of obtaining irrigation equipment assistance from the industry. A suitable system was quickly designed for estimate purposes, and plans were laid for experiment station personnel to carry this question to industrial cooperators at an early date. An outline of this proposed study will be submitted at an early date.

"On January 27 the Project Supervisor with Mr. A. H. Eichmier, U. S. Weather Bureau, left Lansing to reactivate the cooperative snow-survey study now in effect between the two agencies for the purposes of flood forecasting in the Saginaw River Drainage Basin. In this study regular snow surveys are made during the latter part of the winter in this area, and the results radioed to the East Lansing Weather Bureau offices for correlation and forecast. Because of major automotive failure, only one field contact was made. The reactivation program will be carried out the first week in February by Mr. Eichmier and his assistant Mr. Schaal."

Hydrologic Studies - T. J. Edminster, Blacksburg, Va.-"Messrs. Holtan and Kirkpatrick were assigned to a study of the dependability of supplies to farm ponds from surface runoff water. For the present, basic tables of available runoff data applicable in the Ridges and Valleys Section of Virginia are being prepared. This study deals with mass runoff and constitutes primarily prognostication of minimum amounts for various periods.

"A conference was held with Mr. Harry Edwards, Chief, Water Conservation Divisio with regard to possibility of cooperation with the Flood Control staff in settir up and maintaining a series of small gaged watersheds on the Middleburg Pasture Experiment Station in Northern Virginia. It was pointed out that since these stations would be in the Rappahannock watershed that such work might be carried out on the basis of being pre-survey investigations. Further work is being done in development of this proposed cooperation.

Hydrologic Studies - A. W. Cooper, Auburn, Ala.-"Mechanical analysis (table 1) and specific gravity determinations were completed on the Cecil clay soil being used in the study of the effect of tillage and residue management on the physical properties of soil. An average of six determinations of specific gravity of the Cecil clay was 2.60. Moisture-equivalent determinations were made on soil samples taken from these plots in December. Although there was a slight change from previous determinations, there was no significant difference in the moisture equivalent between treatments.

Table 1.--Mechanical Analysis of Soil

Particle size mm.	Designation	Analysis %
2-1	Fine gravel	0.37
1-0.5	Coarse sand	2.32
0.5-0.25	Medium sand	3.17
0.25-0.1	Fine sand	6.49
0.1-0.05	Very fine sand	9.64
0.05-0.005	Silt	11.63
0.005	Clay	66.38
		100.00

"The four 15 by 50-foot erosion plots on the 15 percent and 20 percent slopes were each divided into two 7-1/2 by 50-foot plots so duplicate measurements could be made in comparing treatments on these slopes. Messrs. Kummer, Cooper, Thornton, Richardson, and Neal visited the Piedmont Substation, Camp Hill, Ala. Mr. Mayton, Superintendent of the station, showed the research work in progress. The main emphasis was being given to the production of grazing crops for beef cattle, dairy cows, and hogs. Some of the crops which were being used either separately or in combinations were crimson clover, ladino clover, fescue grasses white Dutch clover, sericea lespedeza, vetch, subterranean clover, button clover Caley peas, hairy peas, Bermuda grasses, and burr clover. Vetch seems to be the best crop to use in reclaiming areas of low fertility where sheet erosion has removed the topsoil (areas that do not even grow weeds).

"Messrs. Kummer, Cooper, Thornton, and Corley made a two-day trip to the Sand Mountain and Tennessee Valley Substations. At the Sand Mountain Substation most of the time was spent with Mr. Gisendanner, Substation Superintendent, going over the 60-acre farm, which is being used in the study to develop erosion control practices applicable to mechanized farming method--Study R-2-3-1(m).

Although the terraces which had been built had taken away considerable water from pockets, there were still a few depressions that were holding water. (It had rained the previous day.) It is planned to use a land leveler to smooth these areas and fill in the low places.

"Messrs. Cooper, Thornton, and Richardson toured Lee County with Mr. Carter, Work Unit Conservationist, and Mr. Sheppard, District Conservationist, to observe some of the cooperative work being carried on by the Soil Conservation Service with farmers of the county. Some farmers would like information on the use of fescue grasses in outlet channels. Centipede grass is considered a pest by some farmers because it spreads to cover large areas in pastures. It chokes out legumes and desirable pasture grasses and is not suitable as a grazing crop. The need for methods and costs of reclaiming land in the Piedmont with various sizes of machinery was also pointed out."

Sedimentation Studies - L. M. Glymph, Jr., Lincoln, Nebraska.-"A large part of the month was spent on analysis of data and preparation of a report on the sedimentation resurvey of Lake Olathe, the water-supply reservoir for Olathe, Kans. The first survey made on this reservoir was completed in June 1937, when the lake was 4.9 years old. The resurvey was completed in July 1949, 12.1 years after the first survey and 17.0 years after the beginning of storage in 1932.

"The reservoir and its contributing watershed of 5.97 square miles is located in eastern Kansas, about 20 miles southwest of Kansas City. Soils of the watershed are deep, fine textured, gently rolling limestone and shale derivatives; generally similar to those of the Summitt; Labette; Bates, and related series. The reservoir watershed is intensively farmed and more or less representative of the prairie soils in central eastern Kansas and central western Missouri.

"The first survey revealed an annual sediment production rate of 2,499 tons per square mile of contributing watershed. Between the two surveys the rate of sediment production was 3,239 tons per square mile annually, resulting in an average of 2,999 tons for the life of the reservoir. There are no records of runoff into the reservoir, but the observed rates of sediment production are coincident with deficiency and excess of precipitation over the reservoir watershed. There was an average annual deficiency of 4.12 inches rainfall (expressed as average annual departure from a 45-year normal) during the first period and an average annual excess of 2.62 inches rainfall between the two surveys. During the life of the reservoir there has been an average annual excess of 0.62 inch above normal rainfall. Additional study is now being made of rainfall and other factors which have, with rainfall, been responsible for the observed rates of sediment production.

"Data collected as a part of the resurvey permit an interesting observation on the longitudinal gradation of sediment particle sizes in the reservoir. Currents in the reservoir seem to sort and deposit the sediment according to particle sizes. The finer textured material is carried through the impoundage for deposition in the lower portion of the reservoir while the coarser and heavier size particles are deposited as velocities are dissipated in the upstream portions of the basin. These relationships from the dam up the east arm of the lake are shown in the attached table, which appears on the next page.

Table 1.--Longitudinal gradation of sediment sizes, Lake Olathe, 1949

Distance from Dam		Percent of sample less than indicated size						
		Particle size (mm.) and class name (A.G.U. Classification)						
Feet	Percent of total	0.004 coarse clay	0.008 very fine silt	0.016 fine silt	0.032 medium silt	0.064 coarse silt	0.128 very fine sand	0.246 fine sand
100	1.4	52.5	74.0	89.1	97.0	98.9	100.0	100.0
1,100	15.7	45.0	65.3	83.7	92.7	99.1	99.1	100.0
2,720	38.9	38.0	51.3	73.0	89.0	98.0	99.7	99.9
4,220	60.3	20.5	35.4	58.0	79.0	95.3	97.6	98.7
5,120	73.1	15.0	27.7	44.9	68.6	83.0	92.5	97.5

Drainage Studies - T. [illegible] Edminster, Blacksburg, Va.-"Realizing that soil structure alone is not the criterion of soil permeability, I prepared a lis ing sheet having a vertical division for each of the seven degrees of permeabili which was subdivided into three parts for small pores, medium sized pores, and large pores. For each size of pore, three columns were allowed for few, moderat number and many. The horizontal divisions are for soil structure showing type, class, grade, overlap and ease of breakage. With the exception of three sites of graded and packed soil and two sites sampled since A. M. O'Neal was here in July of 1948 were listed. The period of time included was from July 26, 1948, (Site No. VA-103) to June 13, 1949, (Site No. VA-183).

"The geographical distribution of the 44 soil types represented in the 76 sites listed is given in table 1.

Table 1.--The geographical distribution of the 44 soil types represented in the 7 sites listed in order to examine the relationship of soil properties to soil permeability

Geographical division	Number of soil types
Coastal Plain	9
Piedmont:	
Bottom and terrace	10
Upland	18
Mountains and Valleys:	
Bottom and terrace	4
Upland	3
Total	44

"Two hundred and ten soil horizons were listed. In regard to type of structure, table 2 gives the distribution according to degree of permeability. This table appears on the next page.

The statements quoted for this project were prepared by Walter L. Turner, Jr.

Table 2.--The distribution of the 210 soil horizons listed according to the degree of permeability

Type of structure	Degree of soil permeability							Total No. of soil horizons
	1	2	3	4	5	6	7	
Fragmental	2	15	25	28	24	34	19	147
Nuciform				1	2	3	5	11
Granular		2	1	1	3	5	10	22
Platy				1		1		2
Single grain						1		1
Massive		1						1
Structureless						4	2	6
Not given		2	2	3	8	2	3	20
Total	2	20	28	34	37	50	39	210

"Seventy percent of the soil horizons have fragmental structure. The distribution of the 147 soil horizons having fragmental structure indicates that per se it is not a clue to permeability. Mr. Steele in his data already referred to shows the importance of the relationship between the length of the horizontal and vertical axes. And the relative ease of cleavage may be a factor.

"From the distribution of the few numbers for the other types of structure, I might say that nuciform, granular and structureless structure favor the higher degrees of permeability.

"Looking back to the fragmental structure for the distribution of size and numbers of soil pores, I find in general the following:

1. The small pores are associated mostly with the lower degrees of permeability, and are usually few in number.

2. The medium size pores are well distributed as to both degree of permeability and number of pores.

3. The large pores go with the higher degrees of permeability and are mostly many in number.

"The complexity of the listing makes the correlation difficult especially since for a given soil horizon often one or more of the characteristics is missing. Consequently, I suggest that in case some correlation is indicated that for each soil horizon sampled in the future a classification of each factor be made on the bases of preagreed on standards."

Drainage Studies - E. G. Diseker, Raleigh, North Carolina.-"During early January 42 examinations were made for sedimentation in the 13 tile lines at Bethel Experiment. This tile was installed in the spring of 1946, and the quality of the tile was very poor; the joints were not square cut. At that time it was most difficult to secure tile of any kind, even poor quality.

"Considerable silt and fluid sand is present in the soil where this tile was installed. Since the segments of tile which had the joints completely wrapped with roofing paper upon installing, did not show any appreciable sedimentation when examined in the spring of 1948 and 1949, the joints were not examined again at this time.

"The findings from examination of joints which were semi-circled from the top are shown in table 1. It will be noted that excessive deposits were found in the tile which was installed 4 feet deep."

Table 1.--Inspection of tile sedimentation--J. V. Taylor Farm--January 9, 1950
Bethel Experiment
Drainage Research--SCS R2

Tile line No.	Tile depth (ft.)	Evidence of leak	Distance from main (feet)	Depth of sediment (Inches)	Color of sediment	Soil Characteristics
1	2	No	400	1/4	Light gray	Quicksand
1	2	No	200	0		
1	2	No	100	7/8	Black	Mixed soil
2	2	No	400	0		
2	2	No	200	1/8	Black	Mixed soil
2	2	No	100	3/4	Dark	Quick sand
3	2	No	400	1/8	Black	Mixed soil
3	2	No	200	5/8	Light gray	Quick sand
3	2	No	100	7/8	Dark gray	Quick sand
4	2	No	400	1/4	Black	Mixed soil
4	2	No	200	1-1/4	Dark gray	Quicksand &mixed soil
4	2	No	100	2	Dark gray	Quicksand
5	2	No	400	3/4	Dark gray	Quicksand
5	2	No	200	1/4	Black	Mixed soil
5	2	No	100	1	Dark gray	Quicksand
6	3	No	400	1/4	Light gray	Quicksand
6	3	No	200	1/8	Black	Dark soil
6	3	No	100	1/8	Black	Dark soil
7	3	No	400	1-3/4	Light gray	Quicksand
7	3	No	200	3/4	Light gray	Quicksand
7	3	No	100	3/4	Dark gray	Quicksand & mixed soil
8	3	No	400	1	Light gray	Quicksand
8	3	No	200	1	Dark gray	Topsoil
8	3	No	100	1-1/4	Light gray	Quicksand
9	3	No	400	1-3/8	Light gray	Quicksand
9	3	No	200	2-1/2	Light gray	Quicksand
9	3	No	100	1-3/4	Light gray	Quicksand
10	4	No	400	1/8	Dark gray	topsoil
10	4	No	400	1-1/2	Dark gray	Quicksand & topsoil
10	4	No	300	3/4	Light gray	Quicksand
10	4	No	200	1	Light gray	Quicksand
10	4	*Yes	100	3/4	Light gray	Quicksand
11	4	No	400	2-1/2	Dark gray	Clay & soil
11	4	No	200	2-1/8	Light gray	Quicksand
11	4	No	100	2-1/2	Light gray	Quicksand
12	4	No	400	3/4	Dark gray	Clay & mud
12	4	No	300	2	Dark gray	Fine sand
12	4	No	100	3/4	Dark gray	Sediment-mixed soil
13	4	**Yes	400	1-1/2	Dark gray	Topsoil & clay
13	4	**Yes	315	3-1/2	Dark gray	Fine sand & topsoil
13	4	**Yes	250	2-1/4	Dark gray	Fine gray sand
13	4	**Yes	100	2-3/8	Dark gray	Fine sand and small amount gray clay soil

**Leak in tile #13, 315 feet from main; tile removed and repaired.

Drainage Studies - M. G. Gallatin, Homestead, Florida.- "With little or no rain during the period moisture readings increased rapidly in the natural cover and check plots. Readings at the middle of the period were close to the wilting point. Readings for the pine straw and grass mulched areas also increased but not as rapidly as in the check and natural cover plots. Readings made toward the end of the period showed that the pine straw and grass mulched areas were near the wilting point. For the shavings mulched area there was a slight increase in our readings but not nearly as great as the others.

"There has been a marked change in the physical condition of the soil material of these plots. There has been a definite increase in the O. M. for the pine straw and grass mulched area whereas in the check plot the soil material is much lighter in color. There has been very little deterioration of the shavings material.

"In connection with our moisture studies, 1-inch application of water was applied with an overhead irrigation outfit on January 23, 1950. Readings made on January 27, 1950 showed that this area 5 days after irrigation was close to the wilting point, and should be irrigated at least every 7 days if the soil moisture is to be kept at an optimum. During this time of the year with low rainfall, low water table, and usually high drying winds, lime groves must be irrigated once in 6-8 days and mature avocados 8-12 days if moisture is to be held at an optimum.

"During this period of low rainfall there has been no loss of nitrogen due to leaching. Samples run from an area of tomatoes in the marl soil in order to collect some information on leaching in this area showed that since the heavy rains of late October and early November there has been no loss of nitrates due to leaching.

"Analysis of chloride samples collected in the Miami area showed some increase during this period but in no case have we had any increase that might give us concentrations as we found in the winter of 1947 when the concentration increased to the point where crops were damaged.

"Samples collected in the Homestead area in general show a very slight increase in concentration. In those area near the coast where pumping from deep rock ditches is practiced the concentration has increased over that of last month.

"In one area about a half mile west of the structure on the Goulds Canal, high concentrations were found in an area that was pumped for the first time this year. If this season continues at the present trend, we should have some data on this problem.

IRRIGATION AND WATER CONSERVATION DIVISION

Upper Santa Ana Valley (San Bernardino County) - Dean C. Muckel, Pomona California.-"At the request of San Bernardino County, average annual amounts of deep penetration of rainfall on the valley floor of Chino Basin were worked up for the various crops for the period 1927-28 to 1947-48, inclusive. These were as follows:

Crop or land classification	Average annual deep penetration in inches	Crop or land classification	Average annual deep penetration in inches
Citrus	5.20	Corn	6.12
Walnuts	2.76	Olives	1.42
Deciduous fruits	3.12	River bottom	6.27
Grapes	3.58	Domestic	7.16
Truck	6.70	Hay and grain	2.72
Beans	5.86	Fallow	7.38
Alfalfa	3.86	Vol. grass	3.49
Irrigated pasture	3.22	Upper vacant	7.74
Double crop	6.18		
Beets	6.72		

"The second series of soil samples to determine depth of penetration in the Lytle Creek, Devil, Cajon, Bunker Hill, and Rialto-Colton basins was completed during the month. Depth of penetration over most of the area was less than 6 feet. Soi samples were also taken in the Puente Hills in an attempt to determine the disposal of rain falling in this area. Surface runoff is measured by San Bernardino County and an estimate of underflow from the hills contributing to the groundwater supply of Chino Basin is desired."

Drainage of Irrigated Lands - William W. Donnan, Los Angeles, Californ "A major part of the month was spent in prepared two manuscripts for release to Operations. As a result of repeated demands by the Zone Technicians and other engineers in the Operations program, a write-up has been prepared, entitled "Methods of Determining Ground Water Levels and Movements," by W. W. Donnan and George B. Bradshaw. This paper describes the various tools used to determine water-table depths, including open holes, cased wells, drilled wells and piezometers. A complete step-by-step procedure is outlined for installing piezometers. The equipment needed for installing flushing, recording water depth, and removing piezometers is described and illustrated. A short section on jetting piezometer and other observation wells to specific types of drainage problems. This manuscript has been prepared for the information and training program of Operations.

"A second manuscript of similar nature and scope has been prepared entitled "A Falling Head Permeameter for Evaluating Soil Permeability," by C. B. Bradshaw and W. W. Donnan. This paper deals with a complete description of and the operation and use of two types of falling head permeameters developed in Imperial Valley. Included are line drawings of these tools, tabulations, which can be used to facilitate computations and specific examples of the results obtained. This manuscript also was prepared for information and training program of Operations."

San Fernando Valley Investigations (City of Los Angeles) - G. Marvin Litz, Los Angeles, Calif.-"The logs of wells were plotted along five cross sections across the western portion of San Fernando Valley and through the high water-table area. From them a general picture of the stratification and nature of the upper 200 to 300 feet of the valley-fill was obtained. On similar cross sections, the March and November 1949 elevations of ground water were plotted. In this portion of the valley, the valley-fill is clay containing some relatively thin strata and lenses of sand and gravel, with the upper 25 to 100 feet logged as either sands, loams, or clays. The valley floor north and northwest of the problem area and the major portion of the problem area, particularly where the leaking artesian wells are situated, have the upper 25 to 100 feet logged as sands and loams. Along the eastern margin of the problem area and from the southern portion of the area south to the Los Angeles River, the upper 25 to 60 feet of fill is logged as clay. The water-table profiles seem to indicate that this layer of clay acts as a barrier to the natural drainage of the high water-table area."

Water Losses from Reservoirs - Harry F. Blaney, Los Angeles, California.-"Information on monthly evaporation is necessary for the proper operation of storage reservoirs for irrigation and power purposes. During 1949, measurements of water losses by evaporation were continued by city, county, and other organizations in cooperation with the Soil Conservation Service and the California Division of Water Resources. Very little data are available on evaporation from reservoirs in high mountain areas. Measurements made in mountain areas east of Fresno, California, in cooperation with the Southern California Edison, at elevations ranging from 5,376 to 9,193 feet above sea level, are summarized in the following tabulation.

Month	Evaporation, in inches							
	Shaver Lake elev. 5,376 ft.		Huntington Lake elev. 6,953 ft.		Florence Lake ele. 7,346 ft.		Kaiser Pass elev. 9,193 ft.	
	Weather Bureau pan	Screened pan	Weather Bureau pan	Screened pan	Weather Bureau pan	Screened pan	Weather Bureau pan	Screened pan
1949								
May	4.67	3.56	(1)	(1)	5.71	4.22	(1)	(1)
June	8.29	6.91	7.72	5.19	8.19	5.86		
July	8.87	7.19	8.15	5.60	8.59	6.85	8.99	5.89
August	7.27	6.21	6.60	4.64	7.58	5.71	7.31	5.19
Sept.	6.52	5.48	6.02	4.34	6.53	4.69	5.99	4.19

1 Water surface frozen in May and October.

Imperial Valley Drainage Studies - George B. Bradshaw, Imperial, California.-"The installation of drainage tile is steadily increasing each year in the Imperial Valley. During 1949 (456) miles of drainage tile was installed, which exceeded any previous year by 62 miles. This brings the total installation of tile to 1,954 miles. To date approximately 104,040 acres or about 17 percent of the irrigated portions of the valley have been tiled. Both concrete and clay tile are being installed with the clay predominating by about 5 miles.

"The steady increase of tile installation since 1945, as shown in the following tabulation, is a good indication that tile drainage research has yielded profitable returns in the Imperial Valley:

Table 1.--Tile installation in the Imperial Valley, Calif.

Year	Miles	Acres
1942	37.15	2,191
1943	53.24	3,141
1944	54.47	3,214
1945	55.40	3,269
1946	133.00	7,847
1947	325.00	19,190
1948	394.00	17,220
1949	456.00	21,670

Water Spreading for Recharge of Underground Basins - A. T. Mitchelson, Dean C. Muckel, E. S. Bliss, Curtis E. Johnson, Berkeley, California.-"There has been enough precipitation in southern California to permit of small quantities of flood water being diverted from stream channels to prepared spreading grounds. On the San Gabriel River cone near Azusa, approximately 40 second-feet of water was being spread, whereas the capacity of the spreading works is 150 second-feet. The Santa Ana River spreading grounds were operated at about 1/6 capacity of approximately 20 second-feet. In this case a court decree limits the amount of water which can be diverted for spreading--no water to be diverted until the flow in the river channel has reached and exceeded a stipulated quantity.

"San Joaquin Valley.-Considerable time was devoted to developing a technique for packing our small glass percolation tubes so as to decrease variation in percolation rate due to packing. A packing machine was constructed that holds the tubes upright. By means of an eccentric cam, operated by a hand crank, the machine raises the tube to an adjustable height between 1/2 and 3 inches, then lets it drop onto a wooden block. In practice a sand and screen filter is placed in the bottom of the tube which is then placed in the machine and the sand slightly dampened to prevent falling out the bottom. Depth to which soil is to be packed is marked on the outside of the tube with a wax pencil, using a large marked dowel placed inside the tube on top of the filter as a depth gage. A predetermined amount of air-dry screened soil, sufficient to bring the volume weight in the tube to approximately field density (1.55 in this case) is placed in an aluminum funnel with a length of 1/4 I. D. rubber tube attached to the spout. Using a stop watch to control the speed the machine is operated at 1 drop per second while the soil is allowed to run freely from the funnel into the percolate tube. The rubber tube on the funnel is moved around to give uniform distribution of soil. After the soil has all run into the perc tube the top is leveled with the dowel, the machine is again started, this time leaving the dowel on top of the soil to prevent 'sorting.' When the soil is level with the waxed pencil line the proper depth and density have been achieved and the tube is ready for use. Total number of drops is recorded.

"Fifteen tubes were packed in this manner and preliminary tests showed an average for the first 8 hours of 108 cc per hour, an average deviation of only 3 cc per hour, with a maximum rate of 117 cc and a minimum of 102 cc per hour. Previous packing procedures, (reported in November 1949) gave average deviations ranging from 10 cc (for one group of 3) to about 20 cc for another group and variations of over 100 cc per hour between some of the 18 tubes.

"Samples were collected from the 0 - 1-inch depth of Wasco ponds 12 and 20 for total counts. Both showed large numbers of organisms. Averages of eight plates gave total counts of 727 million for pond number 20 and 509 million for pond number 12. Sodium albuminate agar was used in making these counts. Pond number 20 has had no recent additions of organic material. However in 1945, 10 tons of chopped alfalfa per acre were added. It is possible that this additional organic material still has no effect on the micro-organism population. Pond 12 had many para-grass roots in the depth sampled. This pond had a good growth of para-grass which was removed at the soil surface in 1949. The added organic material in the form of roots would serve as food for micro-organisms and contribute to high counts. Organic matter analyses will be made on all samples plated for total counts.

"Soil samples were taken from several percolation tubes and plated for total counts. Anaerobic plates were also made to obtain counts of anaerobic organisms since there were some tubes which gave evidence of anaerobic conditions. Results are not yet available."

R-2-1-2 Seepage Losses from Irrigation Channels - Carl Rohwer, Ft. Collins, Colorado.-"The results of the losses from the seepage rings at various depths have been tabulated and checked. A plot of the results shows that the loss is a function of the depth, but is not directly proportional to the depth because the seepage is not zero at zero depth. This is due to the fact that capillary action will still take place when the depth approaches zero. The effect of temperature on the seepage rate at various depths was also investigated. The results were not conclusive. During the tests the maximum range of temperature of the water was only 12° Fahrenheit and this change occurred as a gradual lowering of the temperature. Consequently it was not possible to distinguish between the reduction of seepage due to the time factor and that due to temperature."

Irrigation Studies - P. Earl Ross, Weslaco, Texas.-"Preplanting irrigation on the H. J. Garrett farm where irrigation application efficiency is to be studied was accomplished this month. Two irrigation efficiencies were run. One check was made on near level run and one on a graded run of approximately 0.2 foot fall per 100 feet. On the near level run an application of 6.3 inches was applied in 1 hour and 30 minutes. Soil samples were taken at 100 feet from the outlet, at mid-point of the 590-foot run and 100 feet from the end of the run. The soil moisture accounted for at these locations in the order named were 6.62 inches, 5.58 inches, and 4.1 inches, respectively. This gives an overall efficiency of 83.8 percent of water applied. The time required for the water to reach the end of the run was 1 hour. The distribution of the water indicates that the time of travel on this type of soil should be lessened. On the graded run only 4.62 inches of water could be applied without breaking the furrows. The soil moisture accounted for was 2.42 inches. The least amount of water was found in the middle of the run which was 1.97 inches; the greatest amount at the far end of the run which was 3.10 inches. Near the outlet 2.30 inches were retained. The overall efficiency was 52.4 percent.

"The volume weight of the soil was found to be 1.52 in the first foot and 1.59 in the second to third foot. This seems exceptionally high for the clay soil involved. It is mapped as soil unit 4 by SCS Operations."

Surface and Sprinkler Methods of Irrigation - Wayne Criddle, Boise, Idaho.-"On January 19 and 20, the first annual meeting of cooperators and interested agencies on the Black Canyon investigations was held. The purpose of this meeting was to review the results of the 1949 studies and to make plans for the 1950 operations. This meeting was attended by representatives of the Idaho Agricultural Experiment Station, the Bureau of Reclamation, Idaho State Reclamation Engineer, Bureau of Plant Industry and the Soil Conservation Service, both Research and Operations.

"A somewhat more intensive study is anticipated on this work for the coming year.

"During the month, personnel of the Boise office attended and participated at four farmer demonstrations held in Richfield, Gooding, Wendell, and Weiser, Idaho at the request of Soil Conservation Service--Operations and the Idaho Extension Service.

"Several manuscripts which have been prepared by various men throughout the West to be used as U. S. D. A. publications were reviewed and suggestions made. These manuscripts were on: (1) Sprinkler Irrigation, (2) Level Irrigation, (3) Contour Furrow Irrigation, (4) Estimating Water Requirements from Climatological and Irrigation Data, and (5) Water Requirements of Irrigated Crops in Nevada."

Irrigation Studies - E. G. Hanson, State College, New Mexico.-"The 108 blocks had been installed in 18 sets with each set containing 6 blocks. The blocks in each set were installed at the following depths: 3/4 foot, 1-1/2 feet, 2-1/2 feet, 3-1/2 feet, 4-1/2 feet, and 5-1/2 feet. As reading of the blocks progressed last summer, it was observed that cracks, forming in the land surface as the ground dried out, exposed the upper blocks thus rendering them ineffective. Recent pit studies show that the cracking of the soil is greatly reduced below the 12-inch depth. A general relocation of the blocks near the upper part of the soil profile (and below the 12-inch depth) was planned to provide a greater number of replicates, thus giving more assurance of having usable data in the event that surface cracks occasionally expose some of the blocks. The blocks mentioned in this paragraph refers to the Bouyoucos blocks.

"Tentative arrangements have been made this month to establish six sites on local farms for moisture depletion studies of cotton and for trial irrigations. The farmers concerned have agreed to provide the necessary labor for all soil sampling before and after each irrigation throughout the coming irrigation season. This office will provide the sampling equipment, train and supervise their personnel to obtain samples, and process the samples and chart the data. (Similar studies will be conducted on three private farms near Hatch, N. M., selected in cooperation with the Caballo Soil Conservation Service District.)

"Tentative arrangements have been made with the Elephant Butte Irrigation Company to obtain two Sparling meters; one sufficiently large to measure water at the head of the farm laterals, and one to measure smaller heads within borders or confined areas selected for irrigation efficiency determinations. The irrigation company will loan these meters without cost asking only that their utility and accuracy be reported to the company."

Irrigation Studies - S. J. Mech, Prosser, Washington.-"The month of January has been the coldest since 1919. Long periods of sustained cold weather ranging as low as 20° below zero have no doubt damaged much of the soft fruit in the valley. A 3-inch snow cover has prevented very deep freezing, and expected damage to wheat and alfalfa are not great.

"Computation of last season's results reached a point where summaries were prepared in table form. Tables A and B giving data on sugar beets at 2 and 7 percent furrow grade can be obtained from the project on request. These show the influence of stream size and soil moisture on irrigation characteristics. The wet plots were irrigated 12 times during the season, the medium 8, and the dry 6. Each line of values is the average of duplicate plots.

"Figure A (which also can be obrained from the project), for example, shows that the wet plot (available moisture 60 - 100 percent) irrigated with a 2q head on a 2 percent furrow grade was irrigated with 136.8 inches applied, 83.0 inches ran off leaving the difference or 53.8 inches as infiltration. The runoff was 60.7 percent of the application and carried 42.58 tons of soil per acre from that plot. Soil Samples taken 2 days before irrigation and 3 days after irrigation stopped showed a gain of 36.01 inches accounted for in the upper 4 feet of soil. When allowance is made for the consumptive use between sampling dates, this figure is raised to 51.58 inches. This 51.58 inches is 95.9 percent of the 53.8 inches added to the soil. The 2.22 inches not accounted for is in all probability percolation below the 4-foot depth.

"The average application rate for that irrigation test was 1.13 inches per hour. The runoff occurred at an average rate of 0.70 inch. The infiltration averaged 0.45 inch per hour for the duration of application. The rates in all cases are surface inches over the plot area. The irrigation was made in furrows spaced 24 inches apart. Because of this narrower spacing, rate comparisons with other crops in the rotation can be made only if the rates for sugar beets are reduced to 2/3 of that shown in the table. This would then give values for comparable furrow spacings. Each plot of sugar beets had 1,500 feet of irrigating furrow, while the same size plot of potatoes and alfalfa had only 1,000 feet.

"The column showing the total moisture gain in the upper 4 feet of soil in percent of infiltration was chosen as the basis for comparing the inherent qualitities of irrigating a 7 percent slope as compared with a 2 percent. It is suggested that this comparison shows the basic differences much better than irrigation efficiency because, under our test conditions, it was inevitable that a large part of our application go through as runoff. Runoff can usually be controlled, but distribution of the water after it gets into the soil seems to be a function of stream size, furrow length, and grade.

"Figure C (which can be obtained from the project) shows the peak and average consumptive use for the same plots. It is quite evident that there is luxury evapo-transpiration at the higher moisture ranges. The annual consumptive use based on a 165-day period, is 46.2, 37.3, and 32.0 inches for the wet, medium, and dry plots, respectively.

"Comparing the annual consumptive use with the total gain in the upper 4 feet. The correlation is very close indeed. It also points to the reason why the greater total infiltrations, caused by greater stream size, were down in the percent of application column. Apparently the distribution along the furrow was not very uniform, or the amount of water added was more than the soil could hold."

3/21/50